UCRL-JC-125139 Abs

Cryogenic Target Integration and Radiation Protection of Near Target Components on NIF

M. Tobin, J. Sanchez, L. Pittenger, G. Dipeso, F. Serduke, A. Anderson, P. Peterson, J. Latkowski, and T. Bernat

Lawrence Livermore National Laboratory
Livermore, CA 94550

The National Ignition Facility is reaching the end of the Title I design phase. This paper outlines implications for facility design of concepts for fielding cryogenic targets on the NIF and discusses radiation protection schemes for close-in components such as the target positioner or weapons effects experiments. Even a no-yield shot with a laser energy of 1.25 MJ results in x-ray and debris loading of ≥ 1 kJ/cm^2 at 10 cm away. This could result in a substantially larger quantity of material being removed than contained in a standard hohlraum or disk target, depending on the area of deposition. Since the NIF target positioner is shadow-shielded by a small area at its tip [~10 cm^2] a material such as B_4C may afford sufficient resistance to ablation to be acceptable. This paper discusses calculations and a validation experiment. The use of a material that is non-condensable after vaporization would also alleviate the 'ablation problem' for larger area components. This paper presents the conceptual design of such a system and details the predicted response of a thin ice layer that is backed with an Al foam to absorb the shock. Designs for validation experiments on Nova using the laser beam to minic x-ray effects are also discussed. The integration of the target positioner system with a cryogenic target system is also discussed, as well as the transport cryostat system itself. Shrapnel generation and the potential threat to the first wall and chamber optics are discussed and possible limitations on NIF target design is discussed. Safety and design issues for neutron heating and activation is considered as well. Finally, ice/frost protection is discussed for an entire mini-chamber that could contain NIF experiments.

***This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under contract No. W-7405-ENG-48.**